UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali
ACADEMIC YEAR	2017/2018
BACHELOR'S DEGREE (BSC)	AGRICULTURAL SCIENCES AND TECHNOLOGIES
SUBJECT	MECHANISATION FOR PRECISION AGRICULTURE
TYPE OF EDUCATIONAL ACTIVITY	D
AMBIT	10517-A scelta dello studente
CODE	19240
SCIENTIFIC SECTOR(S)	AGR/09
HEAD PROFESSOR(S)	COMPARETTI ANTONIO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	3
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**COMPARETTI ANTONIO** Wednesday 11:00 13:00 Dipartimento Scienze Agrarie, Alimentari e Forestali, Edificio 4, Ingresso L, Ufficio n. 137

DOCENTE: Prof. ANTONIO COMPARETTI

PREREQUISITES	Agricultural machines.
LEARNING OUTCOMES	Knowledge and understanding capacity Knowledge and understanding of the technical and working characteristics of machines and instruments needed for implementing precision agriculture, i.e. positioning systems of agricultural machines and within-field crop and soil parameters, sensors for measuring these parameters (including remote sensing), machines (fertiliser spreaders and sprayers) that can be used for precision agriculture, software for mapping geo-referenced data, systems for spatially variable rate crop input (fertiliser, herbicide and pesticide) application, as well as their use methods, interpolation methods of geo-referenced data and soil-crop simulation models. Acquisition of the basic technical and scientific knowledge about machines and instruments needed for implementing precision agriculture, as well as the technical and economic criteria for selecting different types of those offered by the market. Knowledge and capacity of using the language specific of machines and instruments needed for implementing precision agriculture. Capacity of applying knowledge and understanding Capacity of applying the acquired knowledge to the identification of the optimal solutions for environmentally sustainable and effective interventions in precision agriculture. Capacity of indipendently selecting the machines and instruments needed for implementing precision agriculture and activities of technical support in this sector. Opinion autonomy To obtain the capacity of finding data and identifying survey methods, in order to define solutions to the technical problems of precision agriculture. To obtain the capacity of critically assessing the issues and results of the planned interventions. To identify the problems and the related solutions aimed at reducing the used amounts of crop inputs and, therefore, the environmental impact and crop production costs, in order to improve the environmental sustainability and efficiency, respectively, in agricultural farms. To be able to assess the problems of selection and the costs for buying machines and instruments needed for implementing precision agriculture, as well as their management costs, reliability and working safety. Communication skills Capacity of converting the technical and scientific language of the student in a didactic speech and, then, communicating with technicians of the same and different background, as well as describing the technical and working characteristics of machines and instruments needed for implementing precision agriculture and their use methods, in order to improve their efficiency and working capacity. To effectively communicate the theories and choices of the student to a not specialist audience, by transmitting the importance of the proposed choices. Capacity of converting the choices of the student in project papers. Capacity of explaining the types, characteristics, main parts, working, performance and management of machines and instruments needed for implementing precision agriculture, as well as their basic principles of evaluation and selection, also to an inexpert audience. Learning capacity Capacity of updating through the participation to technical and scientific seminars and/or the reading of scientific papers specific of this subject. Capacity of attending in-depth courses and specialised seminars, by using the knowledge obtained within the subject. Capacity of understanding the newly acquired instruments, techniques and methods, developed in research fields.
ASSESSMENT METHODS	The exam candidate will have to answer to three oral questions, in agreement with the suggested references, about all the parts of the course contents: 1) within-field spatial and temporal variability or traditional agriculture and precision agriculture or precision agriculture cycle or positioning systems of agricultural machines and within-field crop and soil parameters or differential correction techniques and services; 2) implementation of precision agriculture to crop harvest or fertilization or plant protection; 3) interpolation methods of geo-referenced data or software for mapping these data or decision support systems or results achievable by spatially variable rate fertiliser and herbicide application or perspectives of precision agriculture. The final test is aimed at assessing if the student has knowledge and understanding of the topics, as well as has obtained interpretative competence and opinion autonomy of real cases. The threshold of pass mark will be achieved when the student shows at least general knowledge and understanding of the topics and minimum practical competences (basic physical quantities and practical aspects of measurements, machines, plants for food processing), as far as the solution of real issues. He will have to show also explanatory and arguing capacities, in order to allow the transmission of his knowledge to the examiner. Below this threshold the exam

	result will be fail. Instead, the more the exam candidate succeeds in interacting with the examiner, by using his explanatory and arguing capacities, as well as the more his knowledge and practical capacities are concerned in detail with the subject of test, the more the assessment will be positive. The assessment is carried out according to a scale ranging from 18 to 30 with honours.
EDUCATIONAL OBJECTIVES	The education objectives of the subject are : - basic technical and scientific knowledge about the machines and instruments needed for implementing precision agriculture, as well as the technical and economic criteria for selecting different types of those offered by the market; - competences about the types, characteristics, main parts, working, performance and management of machines and instruments needed for implementing precision agriculture, as well as the basic principles of evaluation and selection of positioning systems of agricultural machines and within-field crop and soil parameters, sensors for measuring these parameters (including remote sensing), machines that can be used for precision agriculture, systems for spatially variable rate crop input application, interpolation methods of geo-referenced data, software for mapping these data and soil-crop simulation models.
TEACHING METHODS	Lectures and exercises.
SUGGESTED BIBLIOGRAPHY	Basso, Sartori, Bertocco, Agricoltura di precisione - Concetti teorici e applicazioni pratiche, Edizioni L'informatore agrario, 2005. Materiale didattico fornito dal docente sotto forma di presentazioni di MS PowerPoint, pubblicazioni e dispense. MS PowerPoint presentations, papers and lecture notes given by the teacher.

SYLLABUS

Hrs	Frontal teaching
1	Introduction to the course.
1	Within-field spatial and temporal variability. Traditional agriculture and precision agriculture. Precision agriculture cycle.
3	Positioning systems of agricultural machines and within-field crop and soil parameters: GPS (Global Positioning System), GLONASS (GLObal NAvigation Satellite System) and EGNOS (European Geostationary Navigation Overlay System).
1	Differential correction techniques and services: DGPS (Differential GPS).
3	Sensors for measuring within-field crop and soil parameters (including remote sensing).
1	Implementation of precision agriculture to crop harvest: yield mapping. Grain yield sensors and moisture sensors for combine harvesters.
1	Implementation of precision agriculture to fertilisation: spatially variable rate fertiliser application. Fertiliser spreaders usable for precision agriculture.
1	Electronic device for applying rates proportionally related to fertiliser spreader forward speed.
1	System for spatially variable rate fertiliser application.
1	System for "on-the-go" spatially variable rate nitrogen fertiliser application.
1	Implementation of precision agriculture to plant protection: spatially variable rate herbicide and pesticide application. Sprayers usable for precision agriculture.
1	Devices for setting up the flow rate usable for precision agriculture: electronic device for applying rates proportionally related to sprayer forward speed and device for applying mixture concentrations proportionally related to machine forward speed.
1	System for spatially variable rate herbicide and pesticide application.
1	Interpolation methods of geo-referenced data: linear, of nearest point, Kriging.
2	Software for mapping geo-referenced data: GIS (Geographic Information System). Production of yield maps, weed density maps, theoretical and actual fertiliser or herbicide spatially variable rate application maps.
1	Decision support systems: soil-crop simulation models.
1	Results achievable by spatially variable rate fertiliser and herbicide application. Perspectives of precision agriculture.

Hrs	Practice
2	Low cost hand-held GPS mobile receiver.
1	Differential correction techniques: DGPS (Differential GPS).
2	System for the geo-referenced measurement of soil compaction.
1	Interpolation methods of geo-referenced data: linear, of nearest point, Kriging.
2	Production of yield maps, weed density maps, theoretical and actual fertiliser or herbicide spatially variable rate application maps by means of a GIS software.